## OPTO-ISOEATED PHOTOVOLTAIC ISO-GATE ${ }^{\text {TM }}$ MOSFET DRIVERS

DIG-11-06-030
DIG-11-06-150
DIG-11-08-050
DIG-12-06-025

DIG-12-08-010
DIG-12-08-045
DIG-12-06-100
DIG-12-06-250

Features:
$>$ Completely Isolated Voltage Signal Generation
> Dielectrically Isolated
> Logic Circuit Compatibility
> High Open Circuit Voltage
> High Operating Temperature
> Fast Response Time
> High Isolation Resistance
> Excellent Input/Output Linearity
> Self Limiting Gate Voltage

## Applications:

$>$ Gate Drive For MOS devices
$>$ Gate Drive For SCR
> Solid-State Relays
$>$ Interface Between Logic Circuits \& External Loads
$>$ A.T.E. (Automatic Test Equipment)
> Switching Equipment
> Isolation Amplifiers
> Load Control From Microprocessor I/O Ports
> Thermocouple Open Detectors

## Description:

The photovoltaic MOSFET driver is a State-of- the-Art, optically coupled floating power source used primarily to control MOSFETs when electrical isolation between input and output is required. The ISO-GATE ${ }^{\mathrm{TM}}$ is a state-of-the-art optoisolator incorporating DIONICS' photovoltaic (PV) diode arrays and an infrared LED. The diode array is a unique I.C. consisting of series-connected photovoltaic diodes. The diodes are completely isolated from each other and from their common substrate by means of $\mathrm{SiO}_{2}$ Dielectric Isolation (DI). These photovoltaic output chips are electrically isolated but optically coupled to the LED.

The typical input circuit to the LED is a limiting resistor connected in series with the LED. When activated, the LED emits infrared light towards the photovoltaic diode array, which then responds by generating an open circuit voltage (Voc). This Voc is floating and is therefore completely isolated. The Voc value depends on the LED input drive and load impedance. DIONICS, Inc offers a wide variety of package styles including low-cost plastic Mini-DIP's, high reliability TO-5 metal cans, 8 -pin ceramic side brazed DIP's and ceramic chip carriers for hybrid manufacturers. Other custom packages and custom designs are also available.

○ Group I: DIG-11-06-030; DIG-11-06-150; DIG-11-08-050.
○ Group II: DIG-12-06-025; DIG-12-06-100; DIG-12-06-250; DIG-12-08-010; DIG-12-08-045.

* Package Layout:


| * Pin Designation |  | $0$ |
| :---: | :---: | :---: |
| Pin Number | Group I | Groưp II |
| 1 | Input + | - Input + |
| 2 | Input - | ) Input - |
| 3 | Not Connected | Not Connected |
| 4 | Not Connected | Not Connected |
| 5 | Net Connected | Output1+ |
| 6 | Output + | Output1- |
| 7 | Not Connected | Output2+ |
| 8 N | Output - | Output2- |
| N |  | 08/2004 |

## Group I and Group II Equivalent Circuits:



| Absolute Maximum Ratings $\left(\mathrm{T}_{\mathrm{a}}=25^{\circ} \mathrm{C}\right)$ |  |  |
| :--- | :---: | :---: |
| LED Forward Current | Steady State | 100 mA |
| LED Forward Current | Peak 10\% Duty Cycle | 250 mA |
| LED Forward Voltage | $\mathrm{I}_{\mathrm{f}}=20 \mathrm{~mA}$ | $1.7 \mathrm{~V}^{*}$ |
| LED Reverse Current | $\mathrm{V}_{\mathrm{r}}=3 \mathrm{~V}$ | $100 \mu \mathrm{~A}$ |
| LED Reverse Voltage |  | 5 V |
| Output Forward Voltage | $\mathrm{I}_{\mathrm{f}}=10 \mu \mathrm{~A}$ | 20 V |
| Lead Soldering Time | At $260^{\circ} \mathrm{C}$ | 10 sec |
| Storage Temperature |  | -50 to $125^{\circ} \mathrm{C}$ |
| Power Dissipation |  | 150 mW |

* Note: DIG-12-06-100 and DIG-12-06-250 are rated @ 3.4 V Max.
* Individual Channel Electrical Characteristics ( $\mathrm{T}_{\mathrm{a}}=25^{\circ} \mathrm{C}$ )

|  |  | MODEL NUMBERS DIG - |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 12-08-010 |  | 12-06-025 |  | 12-08-045 |  | 12-06-100 |  | 12-06-250 |  | 11-06-030 |  | 11-08-050 |  | 11-06-150 |  | Unit |
| Parameter | Symbol | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. |  |
| Open Circuit Voltage $\mathrm{I}_{\mathrm{led}}=2 \mathrm{~mA}$ | $\mathbf{V}_{\text {oc }}$ |  | 8.0 |  | 6.5 |  | 8.0 |  | 6.0 |  | 6.0 |  | 5.5 |  | 9.0 |  | 6.0 | V |
| $\mathrm{I}_{\text {ed }}=10 \mathrm{~mA}$ |  | 8.0 | 9.0 | 6.5 | 7.5 | 8.5 | 9.0 | 6.5 | 7.0 | 6.5 | 7.3 | 6.0 | 6.5 | 7.5 | 10.0 | 6.5 | 7.0 | V |
| $\mathrm{I}_{\text {ed }}=30 \mathrm{~mA}$ |  | 9.0 | 10.0 | 7.0 | 6.3 | 9.5 | 10.0 | 7.5 | 7.8 | 7.5 | 8.0 | 6.5 | 7.0 | 8.5 | 11.0 | 7.5 | 8.0 | V |
| Short Circuit Current $\mathrm{I}_{\text {led }}=2 \mathrm{~mA}$ | $\mathrm{I}_{\text {sc }}$ |  | 0.5 |  | 1.0 |  | 1.0 |  | 2.0 |  | 3.0 |  | 1.1 |  | 2.0 |  | 3.0 | $\mu \mathrm{A}$ |
| $\mathrm{I}_{\text {ed }}=10 \mathrm{~mA}$ |  | 1.35 | 3.0 | 3.0 | 6.0 | 4.0 | 8.0 | 8.0 | 12.0 | 12.5 | 25.0 | 1.0 | 7.0 | 4.0 | 13.0 | 10.0 | 18.0 | $\mu \mathbf{A}$ |
| $\mathrm{I}_{\text {ed }}=30 \mathrm{~mA}$ |  | 4.0 | 9.0 | 9.0 | 20.0 | 12.0 | 25.0 | 30.0 | 40.0 | 37.5 | 75.0 | 3.5 | 20.0 | 12.0 | 40.0 | 30.0 | 55.0 | $\mu \mathrm{A}$ |
| Turn-On Time $\begin{aligned} & \mathrm{I}_{\mathrm{f}}=50 \mathrm{~mA} ; \mathrm{C}=10 \mathrm{pF} \\ & \text { P.W }=100 \mathrm{us} ; \\ & \mathrm{f}=1 \mathrm{kHz} ; \mathrm{R}_{\mathrm{s}}=10 \mathrm{M} \Omega \\ & \hline \end{aligned}$ | $\mathrm{T}_{\text {on }}$ | - | 3.0 | - | 10.0 | - | 8.0 | - | 3.0 | - | 3.0 | - | 8.0 | - | 5.0 | - | 3.0 | $\mu \mathrm{s}$ |
| Temp. Coefficient <br> (Channels in Series) | $\Theta$ | - | -100 | - | -80 | - | -100 | - | -80 | - | -80 | - | -40 | - | -50 | - | -40 | $\mathrm{mV} /{ }^{0} \mathrm{C}$ |
| Isolation Voltage $\mathrm{I}_{\mathrm{iso}}=50 \mu \mathrm{~A} @ 2 \mathrm{sec}$ | $\mathbf{V}_{\text {iso }}$ | 2500 |  |  |  |  |  |  |  |  |  | 2500 |  |  |  |  |  | VDC |
| Operating Temp. <br> (Channels in Series) | $\mathrm{T}_{\text {op }}$ | $-50^{\circ} \mathrm{C} \quad$ To $\quad+100^{0} \mathrm{C}$ |  |  |  |  |  |  |  |  |  | $-50^{\circ} \mathrm{C} \quad$ To $+80^{\circ} \mathrm{C}$ |  |  |  |  |  |  |
| Turn-Off Time $\begin{aligned} & \mathrm{I}_{\mathrm{f}}=50 \mathrm{~mA} ; \mathrm{C}=10 \mathrm{pF} \\ & \text { P.W = } 100 \mathrm{us} ; \\ & \mathrm{f}=1 \mathrm{kHz} ; \mathrm{R}_{\mathrm{s}}=10 \mathrm{M} \Omega \end{aligned}$ | $\mathrm{T}_{\text {off }}$ | The Photovoltaic array stops generating current within one microsecond of the trailing edge of LED current the discharge time is solely dependent upon discharge circuitry and capacitive load. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Typical Applications

1. Power MOSFET Photovoltaic SPST N/O DC Relavs

2. Power MOSFET SPDT Photovoltaic SPST N/O AC-DC Relays:

3. Power MOSFET Photovoltaic SPST N/O Relays With High Speed Turn-Off:


4. Open Thermocouple Detector:


## 6. Isolation Amplifier:



